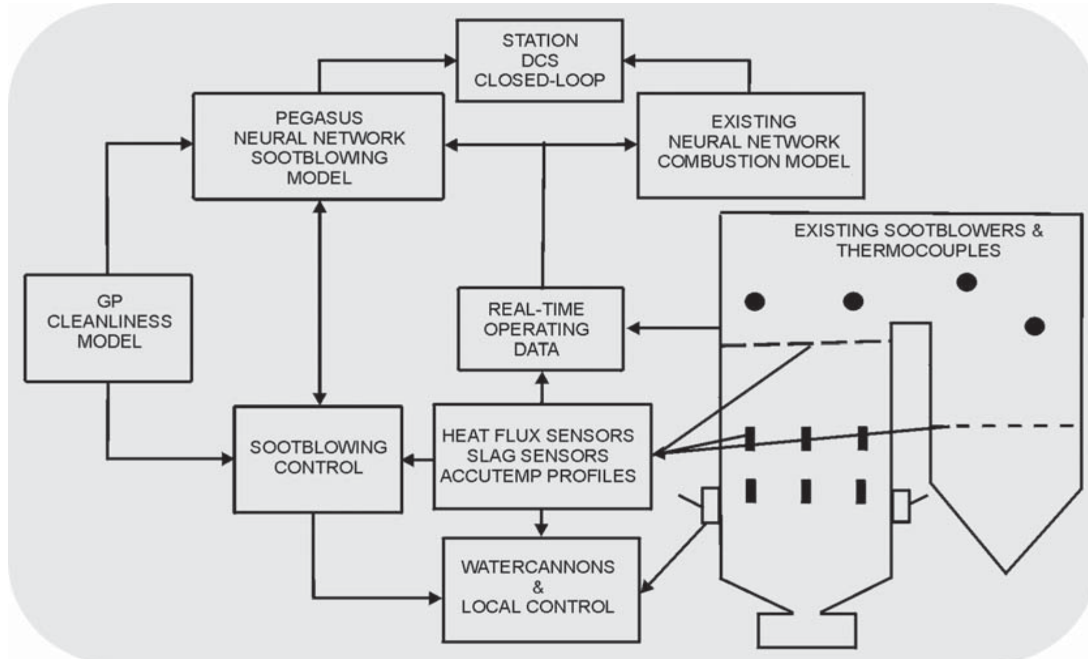
Big Bend Power Station Neural Network-Sootblower Optimization



Participant

Tampa Electric Company

Additional Team Members

Pegasus Technology, Inc.—technology supplier

Location

Apollo Beach, Hillsborough County, FL (Tampa Electric's Big Bend Power Station)

Technology

Neural-network sootblowing system in conjunction with advanced controls and instruments

Plant Capacity/Production

445 MW

Coal

Unknown

Project Funding

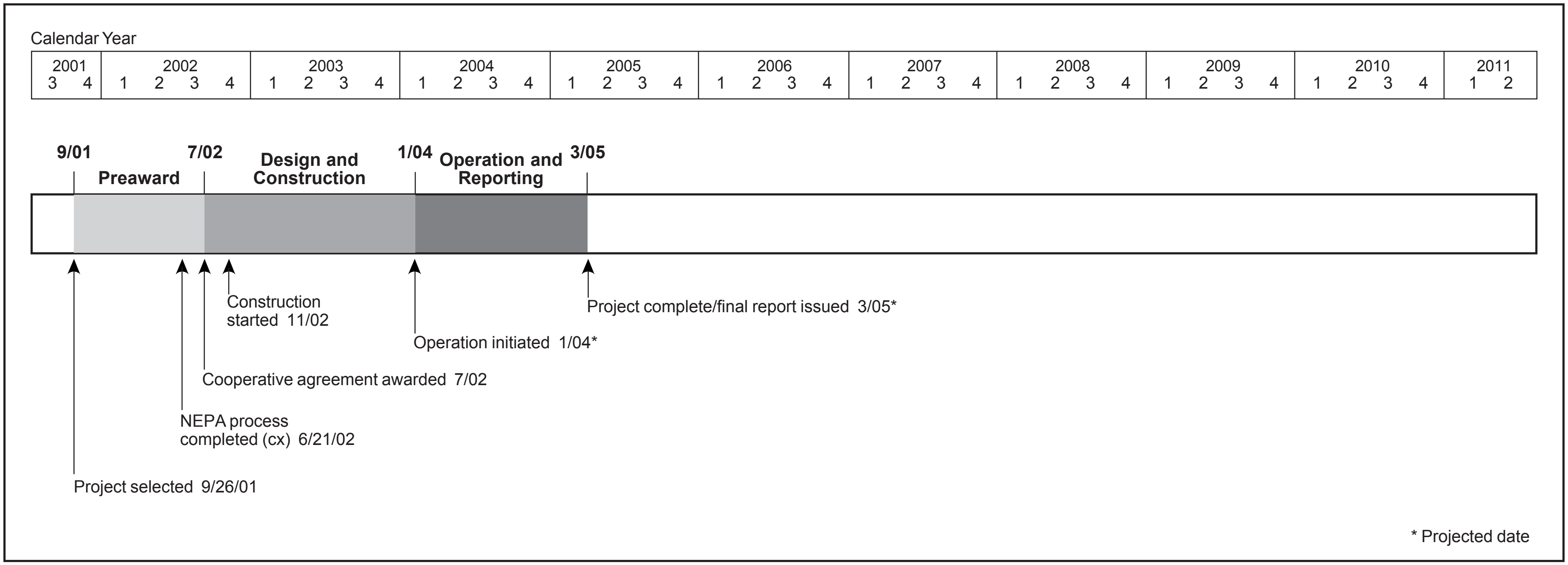
Total	$2,381,614	100%
DOE	905,013	38
Participant	1,476,601	62

Project Objective

To control boiler fouling on a 445-MWe unit by using a neural-network sootblowing system in conjunction with advanced controls and instruments. Ash and slag deposition compromise plant efficiency by impeding the transfer of heat to the working fluid. This leads to higher fuel consumption and higher air emissions, especially NO_x. This project is expected to reduce NO_x by 30%, improve heat rate by 2% and reduce particulate matter (PM) emissions by 5%.

Technology/Project Description

The intent of this project is to apply a neural network intelligent sootblowing system in conjunction with state-of-the-art controls and instruments to optimize the operation of a utility boiler and systematically control boiler fouling. This optimization process is targeted to reduce total NO_x generation by up to 30%, improve heat rate by up to 2%, and reduce PM emissions by up to 5%. As compared to competing technologies, this could be an extremely cost-effective technology, which has the ability to be readily and easily adapted to virtually any pulverized coal boiler.



Project Status/Accomplishments

The project was selected for award on September 26, 2001. The cooperative agreement was awarded July 9, 2002 and the NEPA process was completed with a categorical exclusion issued on June 21, 2002. Construction started in November 2002 and operation is projected to start in January 2004.

Commercial Applications

One problem that exists with the combustion of coal is the formation and deposition of ash and slag within the boilers which adversely affects the rate at which heat is transferred to the working fluid, which in the case of electric generators is water/steam. The fouling of the boiler leads to poor efficiencies because heat which could normally be transferred to the working fluid remains in the flue gas stream and exits to the environment without beneficial use. This loss in efficiency translates to higher consumption of fuel for equivalent levels of electric generation, hence more gaseous emissions are also produced. Another less obvious problem exists with fouling of various sections of the boiler relating to the intensity of peak temperatures within and around the combustion zone.

Total NO_x generation is primarily a function of both fuel- and thermal-NO_x production. Fuel-NO_x, which generally comprises 20–40% of the total NO_x generated, is predominantly influenced by the levels of oxygen present, while thermal-NO_x, which comprises the balance, is a function of temperature. As the fouling of the boiler increases and the rate of heat transfer decreases, peak temperatures increase as does thermal NO_x production.

Due to the composition of coal, particulate matter is also a by-product of coal combustion. Modern day utility boilers are usually fitted with electrostatic precipitators to aid in the collection of PM. Although extremely efficient, these devices are sensitive to rapid changes in inlet mass concentration as well as total mass loading. Traditionally, utility boilers are equipped with devices known as sootblowers, that use steam, water, or air to dislodge particulates and clean the surfaces within the boiler and are operated based upon established rules or the operator's judgment. Without extreme care and due diligence, excessive soot can overload an ESP resulting in high levels of PM being released. This technology has potential application to all of the more than 1,000 coal-fired units.